NOTES FROM PACIFIC COAST OBSERVATORIES.

Note on the Remeasurement of the A Double Stars.

Before publishing a general catalog of the A double stars it is planned to secure a set of measures of each pair at a second epoch. This will indicate not only which pairs are in need of frequent observation, but will also serve as a check upon the earlier measures and identifications. Systematic remeasurement was begun in July of the present year, and, including a few pairs remeasured in 1914, 420 pairs have now (November 4th) been completed. These pairs lie mainly in the third, fourth and first quadrants of the zones 0° to — 10°, + 56° to + 90°, and + 4° to + 12°.

The history of the double stars listed in earlier catalogs led to the expectation that only a small percentage of the A stars would give definite evidence of relative motion in the interval of from 10 to 16 years between the two sets of measures. A comparison, for example, of the measures by Dembowski and Struve of the 405 Σ double stars of Orders I and II (pairs with angular separation of less than 1″ and from 1″ to 2″, respectively) shows that in the interval of 30 or more years only 88 (21.7%) changed as much as 10° in position angle, and only 37 (9.1%) as much as 20°. My 420 remeasured pairs include many that are considerably closer than the closest of the Σ stars, but also 127 that range from 2.″00 to 5.″50 in distance.

In point of fact, 358 of the pairs show an angular change of less than 5°, the average, without regard to sign, being ± 1.°6. Thirty-one of these pairs have an angular separation of 0.″50 or less, the average for all 358 being 1.″81. The distance measures during the present year are systematically larger than at discovery, the average algebraic difference for the 358 stars being + 0.″047. Disregarding the sign the average difference

is ± 0.″066. While it is quite probable that in some instances the changes observed are due to actual motion, these average differences— ± 1.°6 and ± 0.″07—may be regarded as an index to the consistency of the measures.

Probably some of the observed changes in excess of 5° in the 62 remaining pairs are due to error of measure, but it is believed that in the majority of cases, and quite certainly in the 37 pairs in which the difference is as great as 10°, the observed change indicates real motion.[1]

In general these are all close pairs, the distance, except in four instances, ranging from 0.″14 to 0.″83. The wider pairs are:—

Star.	Δ Epoch.	$\Delta\theta$	ρ disc.	$\rho_1 - \rho$	Mag.
A 14	16ʸ.0	+8.°3	3.″76	—0.″69	9.0 — 12.0
111	15 .0	—5. 3	2. 13	+0. 17	8.6 — 12.5
146	14 .2	—6. 2	1. 82	0. 00	7.5 — 10.0
1229	9 .8	—5. 4	1. 49	—0. 25	9.1 — 13.0

The change in A 14 and in A 1229 may be due to the proper motion of the primary, but these stars are not given in any proper motion lists available to me. A 111 and A 146 are well-known proper motion stars. PORTER *(Cinn. Publ.* 12) gives the motion of A 146 as 0.″14 in 155.°5, which would *increase* both the position angle and distance of the companion if independent. My measures are:—

Date.	θ	ρ	n
1901.27	308.°0	1.″82	3
1906.38	305. 2	1. 84	2
1911.29	302. 9	1. 82	1
1915.44	301. 8	1. 90	1

The angular change is therefore probably due to orbital motion. In the case of A 111 the evidence for orbital motion is even stronger. According to PORTER *(Cinn. Publ.* 18), the proper motion of the primary is 0.″285 in 97.°7 and hence, if the companion were independent, its position in 1915 should be about 5.″5 in 257° from the primary. The following measures show the actual relations:—

[1] It must not be forgotten that the measures at both epochs were made by the same observer and with the same telescope. A difference even of 10° would not necessarily imply actual motion if the second measures had been made by a different observer under different conditions.

Date.	θ	ρ	n
1900.71	212.°6	2.″13	3
2.67	212. 1	2. 26	2
4.96	210. 6	2. 30	1
6.81	209. 4	2. 22	2
8.97	209. 6	2. 05	1
11.84	209. 2	2. 19	2
1915.71	207. 3	2. 30	2

On the first night's examination in the present year I found the primary to be a very close double, measures on the two nights giving the position:—

1915.71 262.°5 0.″22 9.3 — 9.3 magnitudes

The seeing was good on many of the nights in earlier years when the wider pair was measured, and the close pair could hardly have escaped detection if the angular separation had been as great as it is now. This is undoubtedly a triple physical system.

Another wide pair deserving special mention is A 53. PORTER *(Cinn. Publ.* 18) assigns the primary the large proper motion of 0.″72 in 78.°1, and SMITH *(Yale Publ.* II, pt. 3) obtains a parallax of + 0.″067 ± 0.″015. My measures are:—

Date.	θ	ρ	n
1900.20	45.°6	4.″94	2
1904.08	44. 8	4. 69	1
1915.81	43. 7	4. 20	2

The magnitudes are 8.5 and 12.5. Assuming the correctness of the first position, the proper motion would place the companion at the time of the last measures in 268° ±, 7.″6 ±, if the two stars were independent. There is little doubt but that the observed change is due to orbital motion.

Of the closer pairs, I shall here list only those in which the angular change exceeds 40° and three which with smaller angular motion have shown also marked change in distance. Attention has been called to three of these stars— A 88, A 417, and A 570—in earlier numbers of these Publications:—

Star.	Δ Epoch.	Δ θ	ρ disc.	$\rho_1 - \rho$	Mag.
A 1	16ʸ.0	+ 24.°4	0.″31	+ 0.″15	8.2 — 8.3
A 88	15 .1	— 406. 8	0. 14	+ 0. 01	6.9 — 7.1
A 93	15 .1	+ 56. 8	0. 28	— 0. 03	9.0 — 9.3
A 235	14 .2	+ 20. 2	0. 20	+ 0. 17	7.9 — 8.1
A 313	13 .0	— 29. 2	0. 19	+ 0. 09	8.4 — 8.8

Star.	Δ Epoch.	Δ θ	ρ disc.	$\rho_1 - \rho$	Mag.
A 417	13.0	+ 146. 5	0. 19	— 0. 03	6.0 — 6.0
A 431	12.0	— 84. 8	0. 19	+ 0. 04	8.5 — 8.5
A 494	12.0	+ 159. 0	0. 14	+ 0. 03	6.9 — 7.8
A 570	12.2	— 119. 6	0. 20	— 0. 02	6.3 — 6.5
A 606	12.3	+ 41. 1	0. 28	+ 0. 02	8.8 — 8.8
A 632	11.9	— 50. 8	0. 45	— 0. 11	8.0 — 8.7
A 693	11.0	— 49. 8	0. 19	— 0. 02	9.0 — 9.0
A 751	10.2	— 67. 5	0. 16	— 0. 03	6.8 — 7.3
A 883	10.9	— 227. 4	0. 14	+ 0. 02	7.6 — 7.8
A1014	9.9	+ 40. 1	0. 25	+ 0. 10	8.6 — 8.6
A1238	10.2	— 46. 7	0. 25	+ 0. 01	7.4 — 7.6

It is practically certain that the motion in all of these systems is orbital. A 751 is too close to measure this year, and the two measures last year were made with great difficulty and are discordant. The change of 227° in A 883 is assigned on the evidence in intermediate years that the motion is retrograde. This year the quadrant was indeterminate.

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THE REMODELED 60-FOOT TOWER TELESCOPE.

In its original form, the 60-foot tower telescope was constructed as cheaply as possible, using a single standard water-tank tower built by the Aermotor Company, and small canvas-covered shelters for the coelostat and second mirror. Its very satisfactory performance made a more permanent arrangement desirable, and it has accordingly been provided with a second tower, supporting a dome, and a closed tube, with double walls, extending from top to bottom and thus protecting the vertical light beam from cross currents of warm air near the ground. The temporary house at the foot of the tower has also been replaced by a concrete structure, enlarged sufficiently to give space for a photographic dark-room.

At the same time various important changes have been made in the auxiliary equipment. The 30-foot spectrograph, improved in various details, may now be easily transformed into an 18-foot spectrograph for use with a quartz invar interferometer. It has also been provided with vacuum and mercury arcs, a device for exposing simultaneously on the arc and solar image, and other new accessories. A 13-foot spectro-heliograph